

## REMARKS

Favorable consideration of this application in the view of the remarks to follow is respectfully requested. Since the present response raises no new issues, and in any event, places the application in better condition for consideration on appeal, entry thereof is respectfully requested under the provisions of 37 C.F.R. § 1.116.

In the outstanding Office Action, the Examiner withdrew prior rejections under 35 U.S.C. §§ 102 and 103. The Examiner introduced new grounds of rejection and made the Office Action final. Applicants submit that the finality of the outstanding Office Action is premature and improper.

Applicants observe that M.P.E.P. § 706.07(a) states the following:

*Final Rejection, When Proper on Second Action*

*Due to the change in practice as affecting final rejections, older decisions on questions of prematurity of final rejection or admission of subsequent amendments do not necessarily reflect present practice.*

*Under present practice, second or any subsequent actions on the merits shall be final, except where the examiner introduces a new ground of rejection that is neither necessitated by applicant's amendment of the claims nor based on information submitted in an information disclosure statement filed during the period set forth in 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17(p).*

Applicants observe that no amendment was made to the present application in the Applicants' prior reply dated September 25, 2006. Further, no information disclosure statement has been filed since the Examiner's Office Action dated July 25, 2006. Applicants submit that the finality of the Outstanding Office Action should be withdrawn.

In the outstanding Office Action, Claims 1-3, 5-8 and 10 stand rejected under 35 U.S.C. § 102(b) as allegedly anticipated by U.S. Patent No. 6,586,311 to Wu ("Wu"). Claim 4 stands

In the outstanding Office Action, Claims 1-3, 5-8 and 10 stand rejected under 35 U.S.C. § 102(b) as allegedly anticipated by U.S. Patent No. 6,586,311 to Wu ("Wu"). Claim 4 stands rejected under 35 U.S.C. § 103 as allegedly unpatentable over the combined disclosures of Wu and U.S. Patent No. 6,777,752 to Osanai et al. ("Osanai"). Claim 9 stands rejected under 35 U.S.C. § 103 as allegedly unpatentable over the combined disclosures of Wu and U.S. Patent No. 5,554,873 to Erdeljac et al. ("Erdeljac").

Concerning the § 102(b) rejection, it is axiomatic that anticipation under § 102 requires that the prior art reference disclose each and every element of the claim to which it is applied. In re King, 801 F.2d, 1324, 1326, 231 USPQ 136, 138 (Fed. Cir. 1986). Thus, there must be no differences between the subject matter of the claim and the disclosure of the prior art reference. Stated another way, the reference must contain within its four corners adequate direction to practice the invention as claimed. The corollary of the rule is equally applicable: Absence from the applied reference of any claimed element negates anticipation. Kloster Speedsteel AB v. Crucible Inc., 793 F.2d 1565, 1571, 230 USPQ 81, 84 (Fed. Cir. 1986).

Applicants respectfully submit that the claims of the present application are not anticipated by the disclosure of Wu since the applied reference does not disclose the claimed structure recited in Claim 1. Specifically, Wu does not disclose a semiconductor IC structure comprising: a semiconductor substrate including at least one front-end-of-the-line device (FEOL) located on a surface thereof; at least one metal resistor located on, or in close proximity to, said surface of said semiconductor substrate, said at least one *metal resistor* comprising at least a conductive metal; and a first level of metallization above said at least one *metal resistor*. Applicants submit that the structure discussed in Wu is a *semiconductor resistor* formed within a semiconductor substrate below the top surface of the semiconductor substrate.

Wu does not disclose “at least one metal resistor comprising at least a conductive metal” as disclosed and claimed in the present application. The Examiner alleges that Wu discloses “at least a conductive metal” and refers to element 430 in FIG. 8 in Wu. Applicants submit that element 430 is an undoped polysilicon layer, as disclosed in column 5, lines 5 – 8 in Wu, which states “As shown in FIG. 4, an undoped polysilicon layer 430 may form a portion of a structure layer 420 such as an epitaxial semiconducting layer.” An undoped polysilicon layer is not considered a conductive *metal* by one of ordinary skill in the art. Therefore, *the structure in Wu, as described by the Examiner, cannot comprise a conductive metal.*

Wu does not disclose “a metal resistor” as alleged by the Examiner. On page 2 of the outstanding Office Action, the Examiner asserted that at least one metal resistor is present in Figure 8 in Wu. *Applicants submit that no metal resistor is present in Figure 8 in Wu, in any of the other figures in Wu, or in any of the disclosure of Wu.* The absence of any metal resistor in Wu is hereafter demonstrated in various ways.

First, examination of the elements that the Examiner alleges to be a metal resistor shows that none of them is a metal resistor. In the Examiner’s response with respect to Claim 1, the Examiner alleges that there is at least one metal resistor in FIG. 8 of Wu. In the Examiner’s response with respect to Claim 2, the Examiner alleges that the elements 640 and 540 are the at least one metal resistor. Examination of the specific reference numerals 640 and 540 in Wu shows that none of elements 640 and 540 are metal resistors, as is elaborated below.

As for the alleged at least one metal resistor in FIG. 8, Applicants submit that there is no such metal resistor in FIG. 8. Applicants assume that the Examiner meant reference numeral 640 in the Examiner’s statement regarding the alleged at least one metal resistor. If this assumption is incorrect, Applicants respectfully request clarification on this subject.

As for reference numerals 640 and 540, which were alleged to be the at least one metal resistor by the Examiner in the statement regarding anticipation rejection of Claim 2, two references to the numeral 640 are found in Wu in column 6, lines 20 – 32. In the first occurrence, Wu discloses that “a lower portion 640 of the salicide blocking structure 600 may be formed by selectively patterning the buffer layer 440 (FIGS. 4 and 5), ...” In the second occurrence, Wu discloses that “the respective portions of the buffer layer 440 to be removed to form the lower portion 640 of the salicide blocking structure 600 may be substantially and/or completely removed by ...” Therefore, the element 640 is a “lower portion” having the same composition as the buffer layer 440. Examination of the composition of the buffer layer 440, as described in column 5, lines 33 – 35, shows that “the buffer layer 440 is comprised of either undoped oxide (UDOX), such as undoped silicon dioxide (SiO<sub>2</sub>), or tetraethyl orthosilicate (TEOS), having a thickness of approximately 50 Angstroms.” Silicon oxide is a dielectric. One of ordinary skill in the art may not employ silicon oxide as a resistor, let alone a *metal* resistor. Clearly, *element 640 cannot be a metal resistor.*

Wu does not describe reference numeral 540 in the specification. Based on FIGS. 7, 9, and 10, however, one of ordinary skill in the art may assume that reference numeral 540 refers to element 640, or at least comprises the same material as element 640. In either case, the element referred to by 540 would be an oxide. Therefore, *element 540 cannot be a metal resistor.*

Second, a text search of Wu for the word, “resistor,” shows only the following occurrences of the word, “resistor”: “Unsalicided resistors have found many applications in complementary metal oxide silicon (CMOS) semiconductor technology” (column 2, lines 42 – 44), “For example, a layer of polysilicon disposed in a semiconducting substrate may form a portion of a resistor” (column 2, lines 44 – 45), “The silicidation of the layer of polysilicon

would render the resistor much less resistive” (column 2, lines 49 – 51), “a conventional salicide block formed of a single layer of silicon dioxide (SiO<sub>2</sub>) or tetraortho silicate (TEOS) is typically formed above such a resistor” (column 2, lines 51 – 54), “As used herein, the circuit elements establish a circuit component, such as an active transistor or a passive component (e.g., resistor)” (column 3, lines 15 – 18), “The undoped polysilicon layer 430 may be formed as a portion of a passive resistor, for example” (column 5, lines 15 – 17), and “5. The method of claim 1, wherein forming the polysilicon layer comprises forming a passive resistor” (Claim 5). This is a complete and exhaustive list of passages containing the word, “resistor,” in Wu.

Applicants observe none of the references to the word, “resistor,” that are cited above have any reference numerals. All the references to the word, “resistor,” are general statements. As for the nature of each of the resistors cited above, the “unsilicided resistor” refers to a resistor comprising a layer of polysilicon. The references to “a resistor,” “the resistor,” and “a passive resistor” thereafter also refer to a layer of polysilicon. A polysilicon resistor is not a metal resistor since polysilicon is not metal. Therefore, *none of the words in Wu containing “resistor” refer to a metal resistor.*

Third, a text search of Wu for the word, “metal,” shows only the following occurrences of the word, “metal”: “a metal oxide semiconductor field effect transistor (MOSFET or MOS transistor) 100” (FIG. 1 and column 1, line 59), “a cobalt (Co) metal layer 235” (FIG. 2 and column 2, line 17 and other instances thereafter), “complementary metal oxide silicon (CMOS) semiconductor technology” (column 2, lines 43 – 44), “an N-channel metal oxide silicon field effect transistor (MOSFET or MOS transistor)” (column 3, lines 30 – 31), “a metal oxide semiconductor field effect transistor (MOSFET or MOS transistor)” (column 4, lines 39 -40), “a cobalt (Co) metal layer 700” (FIG. 7 and column 6, line 33 and thereafter), and “a metal oxide

semiconductor field effect transistor (MOSFET or MOS transistor) 900” (FIG. 9 and column 6, lines 65 – 66). Of all the occurrences of the word, “metal,” that are cited above, references to elements containing physical metal consist only of the following: “a cobalt (Co) metal layer 235” and “a cobalt (Co) metal layer 700”. Examination of FIG. 2 and FIG. 7 shows that ***both elements refer to a blanket cobalt metal layer***. A blanket metal layer may not be considered a resistor by one of ordinary skill in the art. Therefore, ***no references including the word, “metal,” in Wu actually refers to a metal resistor.***

Wu provides a method of fabricating a semiconductor structure in which a salicide block mask prevents the formation of silicide on a portion of the silicon substrate. This is an improved method of forming a structure known prior to Wu. The resistor structure enabled by Wu is a silicon resistor located within the silicon substrate and ***comprises a doped silicon or undoped silicon***. Doped silicon or undoped silicon is not a metal. ***The disclosure of Wu does not enable either a metal resistor or a metal silicide resistor.***

It is evident that Wu does not disclose any metal resistor. **Applicants respectfully request the Examiner to explain which part of the structures disclosed in Wu contains a metal resistor or to withdraw the anticipation rejection based on Wu.** Applicants specifically request the Examiner to identify a metal resistor in Wu either as an element in a figure or a passage in the specification, if Wu in fact discloses or teaches a metal resistor. If such identification is not possible, Applicants request that the anticipation rejection be withdrawn.

With respect to the anticipation rejection of Claim 3, Applicants submit that column 7, lines 9 in Wu does not disclose Ta, TaN, Ti, TiN, W, WN, NiCr, or a metal silicide. The quotation of column 7, line 9 reads “in various illustrative embodiments, the dielectric spacers 925 and the upper portion 550 of the salicide blocking structure 600 may be formed at

substantially the same time.” *Applicants specifically request the Examiner to provide a passage in Wu that discloses the various compositions of the conductive metal, if Wu indeed discloses the various compositions, or withdraw the anticipation rejection of Claim 3.*

With respect to the anticipation rejection of Claim 5, Applicants submit that column 5, lines 46 – 48 and 54 – 56 in Wu do not disclose a thickness of a conductive metal. Quoting the corresponding passages in Wu, “the dielectric layer 450 may have a thickness T in a range of about 100-900 Angstroms. In one illustrative embodiment, the dielectric layer 450 is comprised of silicon nitride ( $\text{Si}_3\text{N}_4$ ), having a thickness of approximately 200 Angstroms, formed by, ....” and “the dielectric layer 450 may be patterned, using a photoresist mask (not shown), for example, to form an upper portion 550 of a salicide blocking structure, such as salicide blocking structure 600, as shown in FIG. 6 and as described in more detail below. The upper portion 550 of the salicide blocking structure 600 may have a width W of at least about 1500 angstroms.” Clearly, both the element 450 and the element 550 comprise a dielectric material. Therefore, *Wu does not disclose a thickness of a conductive metal*, which Applicants submitted not to be present in the structure disclosed in Wu in the paragraphs above.

Applicants further note that Wu does not disclose a first metallization level atop the metal resistor, as presently claimed. A metallization level, as is well known to those skilled in the art, represents a dielectric material that has conductive features (conductive vias and/or lines) embedded therein. This is demonstrated in FIG. 3F in the present application. Therefore, *metallization level must be able to pass significant amount of current for the operation of devices connected thereto*. Applicants find no such metallization level in Wu. In the prior Office Action dated July 25, 2006, the Examiner alleged that the metal layer 700 constitutes a metallization level. In the Applicants’ prior reply dated September 25, 2006, Applicants

submitted that *structures obtained out of the metal layer 700 are not metallization, as it is referred to in the industry or in the present application*. In the outstanding Office Action dated January 26, 2007, the Examiner indicated that the prior rejections have been withdrawn. In issuing a new anticipation rejection based on a new ground(s) of rejection, the Examiner does not mention one of the elements of the present invention as claimed in Claim 1, which is the presence of a first level of metallization. As the anticipation rejection stands in the outstanding Office Action, the Examiner does not indicate how Wu discloses or teaches a first level of metallization. *Applicants submit that there is no disclosure or teaching for a first level of metallization in Wu, and thus, traverse the Examiner's anticipation rejection on Claims 1 – 3, 5 – 8, and 10.*

The foregoing remarks clearly demonstrate that the applied reference does not teach each and every aspect of the claimed invention, as required by King and Kloster Speedsteel; therefore the claims of the present application are not anticipated by the disclosures of Wu. Applicants respectfully submit that the instant § 102 rejection has been obviated and withdrawal thereof is respectfully requested.

With respect to the various obviousness rejections, Applicants submit the combined disclosures of Wu and Osanai et al., or Erdeljac et al., do not render the claimed structure obvious since the applied reference does not teach or suggest the structure presently claimed. That is, the combined disclosures of Wu and Osanai et al., or Erdeljac et al., do not teach or suggest a semiconductor IC structure comprising: a semiconductor substrate including at least one front-end-of-the-line device (FEOL) located on a surface thereof; at least one *metal resistor* located on, or in close proximity to, said surface of said semiconductor substrate, said at least



one metal resistor *comprising at least a conductive metal*; and *a first level of metallization above said at least one metal resistor*.

The principal applied reference to Wu, which spurs each of the obviousness rejections, is defective for the reasons discussed above in regard to the anticipation rejection. Applicants thus incorporate the above remarks herein by reference. The applied reference does not teach or suggest a metal resistor, as presently claimed. Moreover, no metallization levels are taught or suggested in Wu.

The above defects in Wu are not alleviated by Osanai and/or Erdeljak since the applied secondary references also do not teach or suggest the claimed structure in which a metal resistor is present and a first metallization level is located above the metal resistor. While Osanai discloses a polycrystalline silicon resistor, it does not disclose a metal resistor or a first metallization level atop the metal resistor, as presently claimed. Erdeljak is further removed that Osanai et al., since it is directed to polysilicon resistors, not metal resistors, as presently claimed.

In view of the above remarks, the obviousness rejections citing Wu and Osanai, or Erdeljak, have been obviated. Reconsideration and withdrawal of the obviousness rejections are thus respectfully requested.

The various § 103 rejections also fail because there is no motivation in the applied references which suggest modifying the disclosed structures to include the various elements recited in the claims of the present invention. Thus, there is no motivation provided in the applied references, or otherwise of record, to make the modification mentioned above. "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." In re Vaeck, 947 F.2d, 488, 493, 20 USPQ 2d. 1438, 1442 (Fed.Cir. 1991).

The rejections under 35 U.S.C. § 103 have been obviated; therefore reconsideration and withdrawal thereof are respectfully requested.

Thus, in view of the foregoing amendments and remarks, it is firmly believed that the present case is in condition for allowance, which action is earnestly solicited.

Respectfully submitted,



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